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Memorandum

To: Gary Stern – National Marine Fisheries Service
From: Lisa Porcella – Fisheries Biologist- Santa Clara Valley Water District
Subject: Fish Trapping
Date: January 23, 2002

Here is a summary of the SCVWD's fish trapping efforts compiled by the SCVWD fisheries biologists for 1998-2001 upmigrant trapping and 1998-2000 outmigrant trapping. During several of the trapping seasons the SCVWD biologists were not given permission and/or funding to trap early enough in the season and/or late enough to catch the entire migration. The SCVWD biologists believe, given the appropriate funding to trap during the entire expected migration window, that utilizing the trapping methodologies described below would be an effective way to develop an index to help determine the status and health of the salmonid fishery in the Guadalupe River Watershed.

As requested, SCVWD biologists estimate that outmigrant trapping efforts from February 20 –June 10, 2002 will require 2-3 staff to check the trap site daily and process captured specimens at a rate of approximately 3 hrs/day. This translates to ~ (3 hrs/day) * (111 days in the outmigrant trapping season) = 333 hours to service the trap *(3 people/visit) = 999 man hours for 3 people for the outmigrant trapping season.

Feel free to call if you have questions.

Sincerely,

Lisa Porcella
Fisheries Biologist
Santa Clara Valley Water District
(408) 265-2600 x2741

Cc: Don Arnold, David Salsbery, Jae Abel

Chinook Adult Upmigrant Trapping Efforts –

Purpose-

Determining the timing of salmonid upstream migration is important in avoiding impacts to the fishery resource with regard to work in the channel or top of bank in and out of the flood control construction area. Strength of the run (estimated abundance) will also be important in determining potential limiting factors influencing the population. Information collected from adult salmonids will provide data on the length and age structure of returning adults, sex ratios, tissue samples for genetic analysis, ease of fish passage, and help qualify other monitoring results (i.e., fall juvenile surveys, outmigrant trapping, etc.).

Trap Set-up –

(See Figure 1 for the trap design schematic.) The funnel weir trap is a custom design that is installed at the tail-out of a pool or glide. When set, the trap cage is almost entirely submerged in the pool or glide thalweg. The trap setup consists of fencing installed across the entire stream with a V shape opening downstream and a trap cage integrated at the apex of the V (Figure 2). The weir and trap cage is constructed of 14-gauge, 1" X 2" welded wire fencing material. The weir fencing is supported by T-posts driven into the streambed and anchored to the substrate by sandbagging a folded flap of the fencing along the entire base. The weir fencing extends above the water line several feet and a matching extension is added to the top margin of the trap cage to preclude fish from jumping over the weir and trap. The trap cage is secured to the fence weir by way of trap cage wing flaps that overlap the center weir fence wing flaps. The trap cage is further secured by a wing apron extending from the trap opening that is sealed against the stream substrate with sandbags. A pair of stabilizing T-posts brace the trap sides and act as a “shear-pin” catch for a pipe threaded horizontally through the trap sides on the upstream side of the posts. Anchoring guy lines are attached to the rearward trap box corners. Sandbags placed along the trap cage base further stabilize the cage. The guy lines are fitted with slipknots and the anchoring sandbags are fitted with retrieval lines and floats to facilitate easy removal in the event of high flows.

Upstream of the trap, debris baffles are fashioned by installing T-posts and wire fencing with a 1" X 1" plastic fencing “peel-off” sheet on the upstream side. These are installed in a staggered placement, each crossing approximately ½ of the stream width. They function to collect smaller organic and “urban” debris that would otherwise clog the trap. The plastic “peel-off” fencing is also used on the weir. This further acts to seal the weir and keep fish from “testing” the fencing for through-passage.

The trap cage is a rectangular box shape with a short, intruding funnel on the downstream end that leads fish through a trap door into the trap box. The entire cage measures 6'L X 4'W X 3'H. The trap is serviced by way of a hinged lid on the top that is secured with spring clips and wire-wrap ties (Figure 3). The corners of the trap box are padded with closed-cell foam to reduce injury and provide floatation to the cage during removal. Shade cloth is draped over the top of the trap during each set, to reduce exposure and stress in captured fish (Figure 4).

Trap Operation –

Once the trap is set up, it is operated continuously. The trap is typically checked daily. Frequency of checking the trap may vary depending on debris load, fish numbers, flow conditions, and site security. The trap may be checked twice a day if conditions warrant the increased effort.

During a trap check, a variety of physical measurements are recorded to index the ambient weather and flow conditions; trap set time, and other parameters relative to the trap effort. Species captured and numbers of each species are recorded. Notes on disposition of all fish and other by-catch species are recorded on standardized forms to facilitate completeness and ease of data entry into a computer database.

During a trap check, the captured specimens are retrieved from the trap box and brought to the bank for processing. Fish are handled with dip nets and/or wetted hands (with or without wool friction gloves). Individual measurements are made of target species captured, including fork length, and notes are made of any evidence of hatchery or other markings (e.g. fin clips, tags). Sex and breeding condition is determined (if possible) by visual inspection and stroking the abdomen to detect eggs or stimulate the release of milt (Figure 5).

Tissue samples for genetic analysis consisting of a small (#2mm^2) caudal fin clip may be collected at this time. These specimens are individually marked and stored in filter paper sleeves in paper envelopes for dehydration/preservation. All equipment used to handle or process fish is cleaned between use on individual fish and before use in a different watershed to reduce risk of disease transmission. After processing, individual fish are held upright in gentle stream flow for recovery. All fish are subsequently released upstream of the trap. After all fish are processed, the trap is cleaned of debris and reset.
To help determine if there is trap avoidance by salmonids, at least two surveys during the adult migration period are conducted from the trap site downstream to the tidally influenced zone.

Upmigrant Trapping Results –

Guadalupe River 1998

The 1998 upmigrant trap was installed on the Guadalupe River downstream of Highway 101 on July 16, 1998. The trap was operated continuously until January 15, 1999 when further trapping was precluded due to consistent high flows from a series of back to back storm events (mean daily flows >150cfs at the St. John Street gage ~ 3.6 miles upstream of the trapping station).

Due to the SCVWD's trapping design that enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 140 days of the 183 day trapping period.

The trap was completely removed from the channel for 26 days during the trapping period due to high flow events [Oct 25-26 (storm flows of >140cfs), Nov 8-11(flows >40cfs), Nov 22 (pulse flows from outfall pumping), Nov 24 (pulse flows from outfall pumping), Nov 28 – Dec 11(storm flows >400cfs), Dec 14, Dec 17, and Dec 20-21 (pulse flows from outfall pumping)]. The trap is removed prior to the onset of a major storm event in an effort to remove captured fishes and prevent unnecessary mortalities and undue stress on the fish (Figure 6).

There were 17 days during the trapping season where the trap operated at less than optimal efficiency due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 6 days the trap operated at 90-95% efficiency, 5 days the trap operated at 75-85% efficiency, and 6 days the trap operated at 50-60% efficiency.

Total capture of salmonids during the 163 day trapping period consisted of 84 Chinook salmon (3 of which had adipose clips), and 4 steelhead/rainbow trout. There were no trap or handling related salmonid mortalities during the trapping season (Table 1).

During the 17 days when trapping efficiency was < 100%, 1 additional adult salmonid (± 0.05, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 1 additional salmonid accounts for only 1% of the total salmonid abundance (n=89) for the season (Table 1).

The 26 days the trap was completely removed from the channel appeared to fall toward the end of the run as seen in Figure 6, and therefore it is anticipated that only a small fraction of the total run was missed. Statistical modeling to fill in the blanks for days when the trap was removed from the channel is deemed not feasible by the SCVWD due to the small numbers of fish obtained within this system and the propensity for a large margin of statistical error.

Guadalupe River 1999

The 1999 upmigrant trap was installed on the Guadalupe River downstream of Highway 101 on August 13, 1999. The trap operated continuously for 50 days when funding for the project was withdrawn and the trap had to be removed on October 2, 1999.

Due to the SCVWD's trapping design which enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 48 days of the 50 day trapping period.

The 2 days during the trapping season where the trap operated at less than optimal efficiency was due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 1 day the trap operated at 95% efficiency and 1 day the trap operated at 50% efficiency. At no time during the trapping season did higher flows require the trap to be entirely removed from the channel (Figure 7).

Total capture of salmonids during the 50 day trapping period consisted of 40 Chinook salmon (1 of which had adipose clips) and 1 chum salmon (Table 1). There was only one trap related mortality during the trapping period. However, the Chinook salmon which turned up dead in the trap on August 25, 1999 was missing an adipose fin and was therefore collected to determine its hatchery origin. The coded wire tag was excised and decoded by Melodie Palmer of the CDFG in Healdsburg, Ca. Her results concluded that the fish was from the CDFG owned and operated Feather River Hatchery and was released in 1997.

During the 2 days when trapping efficiency was < 100%, 1 additional adult salmonid (± 0.05, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 1 additional salmonid accounts for only 2% of the total salmonid abundance (n=42) for the season (Table 1).

The trap appears to have been installed early enough in the season to catch nearly all of the fall-run Chinook salmon (Figure 7). However, due to funding problems the trap was removed too early to catch the end of the run. The SCVWD is not aware of a statistical model which can accurately predict either the beginning of a run or the tail end of a run without the apex of the capture curve. The SCVWD also does not feel a statistical model of this magnitude would be feasible to apply to this system due to the small numbers of fish obtained and the propensity for a large margin of error.

Guadalupe River 2000

The 2000 upmigrant trap was installed on the Guadalupe River downstream of Highway 101 on August 17, 2000. The trap operated continuously for 54 days when funding for the project fell through and the trap had to be removed on October 10, 2000.

Due to the SCVWD's trapping design which enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 51 days of the 54 day trapping period.

The 3 days during the trapping season where the trap operated at less than optimal efficiency was due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 2 days the trap operated at 85-90% efficiency and 1 day the trap operated at 50%

efficiency. At no time during the trapping season did higher flows require the trap to be entirely removed from the channel (Figure 8).

Total capture of salmonids during the 54 day trapping period consisted of 13 Chinook salmon, 1 chum salmon, and 1 pink salmon. There were no trap or handling related salmonid mortalities during the trapping season (Table 1).

During the 3 days when trapping efficiency was < 100%, 0 adult salmonids were captured in the trap and therefore no additional salmonids could be calculated to add to the total abundance data (Table 1). This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day.

The trap appears to have been installed early enough in the season to catch the entire fall-run (Figure 8). However, due to funding problems the trap was removed too early in the season to catch the peak of the run. Similar to the 1999 data, the SCVWD is not aware of a statistical model which can accurately predict either the beginning of a run or the tail end of a run without knowing the apex of the capture curve. The SCVWD also does not feel a statistical model of this magnitude would be feasible to apply to this system due to the small numbers of fish obtained and the propensity for a large margin of error.

Guadalupe River 2001

The 2001 upmigrant trap was installed on September 12, 2001 following a communication between the National Marine Fisheries Service (NMFS) and Nina Bicknese of the US Army Corps of Engineers on September 11, 2001. As previously discussed, the trap was installed on the Guadalupe River downstream of Highway 101 and trapping was scheduled to continue until December 1st in order to avoid capture of upmigrating adult steelhead. The trap was operated continuously until November 24, 2001 when further trapping was precluded due to consistent high flows from a series of back to back storm events (mean daily flows >350cfs at the St. John Street gage ~ 3.6 miles upstream of the trapping station). This removal date was only 6 days prior to the mandated removal date by NMFS of December 1, 2001.

Due to the SCVWD's trapping design which enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 56 days of the 73 day trapping period.

The trap was completely removed from the channel for 5 days during trapping period due to high flow events (Oct 31 (outfall caused pulse flows of ~30cfs), and Nov 12-15 (storm flow of ~350cfs) (Figure 9). The trap is removed prior to the onset of a major storm event in an effort to remove captured fishes and prevent unnecessary mortalities and undue stress on the fish.

There were 12 days during the trapping season where the trap operated at less than optimal efficiency due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 2 days the trap operated at 90% efficiency, 3 days the trap operated at 75-85% efficiency, 2 days the trap operated at 40-50% efficiency, and 5 days the trap operated at 10-20% efficiency.

Total capture of salmonids during the 73 day trapping period consisted of 49 Chinook salmon (2 of which had adipose clips), 1 steelhead/rainbow trout (which was deemed a potential resident), and 2 chum salmon. There were no trap or handling related salmonid mortalities incurred during the 2001 trapping season (Table 1).

During the 12 days when trapping efficiency was < 100%, 10 additional adult salmonids (± 0.5, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 10 additional salmonids account for only 16% of the total salmonid abundance (n=62) for the season (Table 1).

The 5 days the trap was completely removed from the channel occurred toward the end of the fall-run as seen in Figure 9, and therefore it is anticipated that only a minor fraction of the total run was missed. Statistical modeling to fill in the blanks for days when the trap was removed from the channel is deemed not feasible by the SCVWD, due to the small numbers of fish obtained within the system and the probability of a large margin of statistical error.

The trap was installed a bit later than was optimal and therefore the very beginning of the Chinook fall run may have missed. However, according to the trapping data presented in Figure 9, it appears that the majority of the 2001 fall-run Chinook were captured.

Coyote Creek 1999

The 1999 Coyote Creek upmigrant data is included here to show the invaluable benefits gained from a full year of trapping (i.e., fall upmigrant trapping & spring outmigrant trapping). The data presented here correlates with the 2000 Coyote Creek outmigrant data listed in the section below. The fisheries sampling on Coyote Creek was performed as part of a monitoring program for the Coyote Creek Standish Dam project.

The 1999 upmigrant trap was installed on Coyote Creek downstream of Montague Expressway on August 24, 1999. The trap was operated continuously until November 8, 1999 when further trapping was precluded due to consistent high flows from a series of storm events. (Flows >13cfs at Edenvale, visual on-site estimate >30 cfs; flow readings from the Edenvale gage are not optimal since the gage is over 13.5 miles upstream of the trapping location.)

Due to the SCVWD's trapping design which enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 73 days of the 76 day trapping period (Figure 10).

The 3 days during the trapping season where the trap operated at less than optimal efficiency was due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 1 day the trap operated at 90% efficiency and 2 days the trap operated at 50% efficiency. At no time during the trapping season did higher flows require the trap to be entirely removed from the channel.

Total capture of salmonids during the 76 day trapping period consisted of 77 Chinook salmon (4 of which had adipose clips). There was only one trap related mortality during the trapping period (Table 1). The Chinook salmon which turned up dead in the trap on October 29, 1999 was a ripe female in seemingly good condition.

During the 3 days when trapping efficiency was < 100%, 2 additional adult salmonids (± 0.1, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 2 additional salmonids account for only 3% of the total salmonid abundance (n=79) for the 1999 season (Table 1).

The trap appears to have been installed early enough to catch nearly all of the fall-run Chinook salmon (Figure 10). However, trapping for the season was terminated a bit prematurely due to high flow conditions. Similar to the Guadalupe River 1999 data, the SCVWD is not aware of a statistical model which can accurately predict either the beginning of a run or the tail end of a run without knowing the apex of the capture curve. The SCVWD also does not feel a statistical model of this magnitude would be feasible to apply to this system due to the small numbers of fish obtained and the propensity for a large margin of error.

Juvenile Outmigrant Trapping Efforts –

Purpose -

Seasonal timing and the environmental conditions that facilitate the emigration of salmonids are critical to the annual construction window of the Guadalupe River Flood Control Project. Determining an index of run strength will be important in relation to identifying potential limiting factors. Capture and tagging of juvenile salmonids will also help indicate if adult fish that migrate upstream are possibly part of self-sustaining run of the Guadalupe River Watershed as well as help qualify other monitoring results.

Trap Set-up –

The criteria for establishing the trap site includes selecting a location sufficiently downstream in the system that any smolts captured would have a reasonably high probability of completing passage out of the system. Other factors such as site access, site security, and stream configuration for trap equipment installation and operation are also considered. (See Figure 11 for trap design schematics.)

A fyke net trap, 28 feet long, tapering from the mouth at 10 feet wide by 5 feet high down to the throat at 9 inches wide by 7 inches high, is used to collect and funnel downstream migrant fishes into trap boxes. The two live car trap boxes are connected in series to the fyke net throat in a floating configuration with flexible collars between the net and boxes. The boxes, measuring approximately 18 inches high by 24 inches wide by 36 inches long, are of plywood construction, rectangular shape, with flow-through screening along the sides and a hinged lid on top for servicing. In a paired series, the first box has inlet and outlet ports measuring 9 inches wide by 7 inches high, whereas the second (downstream) box has an inlet port only. Inside the front box, a screen funnel is attached at the inlet. This funnel tapers slightly down and acts as a flow dissipater to assist in retaining trapped fish. A V-shaped flow deflection baffle is permanently affixed in each trap box: toward the outlet end of the front box; and 6 inches in from the inlet port of the rear box to further create flow diversions that will aid in fish retention and create eddy pockets for fish to hold in and behind.

The net is supported by a rectangular metal pipe frame placed in stream, sandbagged, and anchored with a rigging harness and guy lines fashioned to t-posts set in series in the stream and bank. The trap boxes are also tethered by safety lines to trees or other substantial anchor points along the stream bank. The net/trap box configuration is installed in the stream such that the mouth of the net is centered upstream in a shallow riffle/run and the trap boxes trail, floating downstream in a deeper run/head-of-pool position. The trap setup also consists of fencing installed across the entire stream in a V shape opening upstream with the fyke net integrated at the apex of the V. The 1" X 1" welded wire fencing material is anchored to the channel bottom by means of T-stakes and is covered with ½ inch delta mesh netting to prevent even the smallest fish from bypassing the trap opening (Figure 12). Sandbags may also be used instead of fencing in the event that the channel is narrow (Figures 13 &14). The addition of wings to the trap setup allows for sampling of the entire stream width/flow enabling 100% fishing efficiency. Upstream of the trap, debris baffles are fashioned by installing t-posts and wire fencing with a 1" x 1" plastic fencing “peel-off” sheet on the upstream side. These are installed in a staggered placement, each crossing approximately ½ of the stream width. They function to collect smaller organic and “urban” debris that would otherwise clog the trap.

Trap Operation -

Once the trap is set up, it is operated continuously. The trap may be checked twice each day, morning and afternoon depending on debris load, fish numbers, flow conditions, and site security.

During a trap check, a variety of physical measurements may be recorded to index the ambient weather and flow conditions; trap set time, and other parameters relative to the trap effort. The number of each species captured are recorded. Notes on disposition of all fish and other by-catch species are recorded. All information is recorded on standardized forms to facilitate completeness and ease of data entry into a computer database.

The trap boxes with the captured specimens are retrieved from the net rigging and brought to the bank for sample processing. While awaiting processing, captured salmonids are kept separately either in the trap boxes or in a screened basket live car at stream edge such that streamflow is continuously circulating in the enclosure. Fish are handled with dip nets and/or wetted hands (with or without wool friction gloves). Individual measurements are made of target species captured including fork length and condition. Notes are made of any evidence of prior markings (e.g.. fin clips, tags). Fish to be tagged and/or clipped for genetic specimens may be netted from the trap box or live car and anesthetized by being placed in a separate container of stream water that has been saturated with CO_2 via the use of (unmedicated) Alka-Seltzer tablets. Tissue samples for genetic analysis consisting of a small (#2mm^2) fin clip may be collected at this time. Tissue clips are individually marked and stored in filter paper sleeves in paper envelopes for dehydration/preservation. Individual fish may be marked at this time using one of several marking techniques: PIT tag, injected dye, injected number tag, coded wire tag, etc., depending on species and size and numbers of fish to be marked. Typically, steelhead smolts are marked with PIT tags that are injected abdominally. PIT tags are stored in alcohol prior to use. All equipment used to handle or process fish is cleaned between use on individual fish and before use in a different watershed to reduce risk of disease transmission. After processing, individual fish are replaced in a live car for recovery which typically takes 1-2 minutes and subsequently released downstream of the trap inlet. After all fish are processed, the trap is cleaned of debris and reset.

Juvenile Outmigrant Trapping Results –

Guadalupe River 1998

The 1998 outmigrant trapping season was the SCVWD's first attempt at a 7 day a week outmigrant trapping operation. The trap design was similar to what is discussed above, however, the fyke trap was simply placed in the center of the thalweg and no side-wings were attached. Therefore, the trap did not fish 100% of the channel; rather the fishing efficiency averaged around 50%.

The trap was installed on Guadalupe River downstream of Highway 101 on May 1, 1998. This date turned out to be too late in the season to effectively capture the bulk of the run. The trap was removed on May 30, 1998 when a high flow event precluded further trapping efforts (mean daily flows >250cfs @ St. John Street Weir).

Total capture of salmonids during this one month period consisted of 11 steelhead/rainbow trout and 14 Chinook salmon. Based on the late start for installing the trap, the limited amount of time the trap was actually fishing, the limited efficiency of the trapping design, and the small numbers of fish captured the SCVWD does not feel that this data is robust enough to portray any sort of salmonid abundance index. Statistical modeling of this magnitude would not be feasible to apply to this trapping season due to the small numbers of fish obtained and the probability for a large margin of statistical error.

Guadalupe River 1999

In 1999, the SCVWD improved their outmigrant trapping design by adding angled wings to each side of the fyke net (Figures 12-14). The wings functioned to direct outmigrating fishes toward the mouth of the fyke net. This design modification proved to be very effective and allowed for sampling of the entire channel and hence 100% fishing efficiency.

Unfortunately, due to funding problems the SCVWD was unable to install the outmigrant trap until April 29, 1999. Once again this proved to be too late in the season to capture the majority of the outmigrants. The trap was removed from the channel on June 9, 1999.

Total capture of outmigrating salmonids over the course of this brief trapping period was 4 steelhead/rainbow trout and 66 Chinook salmon. Based on the late start for installing the trap and the small numbers of fish captured the SCVWD does not feel that this data is robust enough to portray any sort of salmonid abundance index. Statistical modeling of this magnitude would not be feasible to apply to this trapping season due to the small numbers of fish obtained and the probability for a large margin of statistical error.

Guadalupe River 2000

No funding was available for outmigrant trapping in the Guadalupe River during the 2000 season.

Coyote Creek

Outmigrant data from Coyote Creek is being presented here to depict the type of data which could be collected for the Guadalupe River system given the appropriate timing, methodology, and funding. The SCVWD feels the Coyote Creek data is a good representation of the type of effort needed to determine the timing of the outmigration and depict a juvenile (outmigrant) abundance index. Additionally, the SCVWD presents the Coyote 2000 outmigrant data coupled with the 1999 upmigrant data to show the benefits gained from a full year of trapping data.

Coyote Creek 1999

As mentioned above for the Guadalupe River sampling in 1999, the SCVWD improved their outmigrant trapping design by adding angled wings to each side of the fyke net for the 1999 outmigrant trapping season (Figure 12-14). The wings functioned to direct outmigrating fishes toward the mouth of the fyke net. This design modification proved to be very effective and allowed for sampling of the entire channel and hence 100% fishing efficiency.

The fisheries sampling on Coyote Creek was performed as part of a monitoring program for the Coyote Creek Standish Dam project.

The 1999 outmigrant trap was installed on Coyote Creek downstream of Montague Expressway on April 14, 1999. The trap was operated continuously until June 14, 1999 when further trapping was deemed unnecessary based on a full week with no salmonid captures.

The SCVWD's improved trapping design enables sampling of the entire channel. The trap operated at 100% trapping efficiency for 55 days of the 61day trapping period.

The trap was completely removed from the channel for 1 day during the trapping period (June 4, 1999) due to a pulse flow event, likely caused by unpredictable outfall pumping (Figure 15).

The 5 days during the trapping season where the trap operated at less than optimal efficiency was due to either scour holes under the wing fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 4 days the trap operated at 90-95% efficiency, and 1 day the trap operated at 50% efficiency.

Total capture of outmigrating salmonids during the 61 day trapping period consisted of 162 steelhead/rainbow and 172 Chinook salmon. There were 2 trap related salmonid mortalities during the trapping period: 1 steelhead/rainbow trout, and 1 Chinook salmon. These mortalities account for only 1% of the total salmonid trap captures (Table 1).

During the 5 days when trapping efficiency was < 100%, 1 additional outmigrating smolt (± 0.05, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 1 additional smolt accounts for only 0.6% of the total steelhead/rainbow trout abundance (n=163) for the 1999 outmigration season (Table 1).

The one day the trap was completely removed from the channel occurred during the tail end of the outmigration period on June 4, 1999 (Figure 15). The SCVWD is not aware of a statistical model which can accurately fill in the missing data for this day. Based on the small numbers of fish obtained within the system and the notion that outmigrating smolts have a greater tendency to move during high flow events, any estimate of missing data would likely have a large statistical margin of error.

The trap appears to have been installed a bit late and the SCVWD may have missed the first half of the outmigration period (Figure 15). Based on the tardiness of installing the 1999 trap, the SCVWD attempted to install the 2000 outmigrant trap earlier in the season.

Coyote Creek 2000

The 2000 Coyote Creek outmigrant data is included here to show the invaluable benefits gained from a full year of trapping (i.e., fall upmigrant trapping & spring outmigrant trapping). The data presented here correlates with the 1999 Coyote Creek upmigrant data listed in the section above. The fisheries sampling on Coyote Creek was performed as part of a monitoring program for the Coyote Creek Standish Dam project.

The 2000 outmigrant trap was installed on Coyote Creek downstream of Montague Expressway on April 4, 2000. The trap was operated continuously until June 15, 2000 when further trapping was deemed unnecessary due to a string of 10 days with no salmonid captures.

The SCVWD's improved trapping design enables sampling of the entire channel, the trap operated at 100% trapping efficiency for 62 days of the 73 day trapping period.

The trap was completely removed from the channel for 1 day during the trapping period due to a high flow event on April 18, 2000 (mean daily storm flow >100cfs at the Highway 237 USGS gage) (Figure 16). The trap is removed prior to the onset of a major storm event in an effort to remove captured fishes and prevent unnecessary mortalities and undue stress on the fish.

The 10 days during the trapping season where the trap operated at less than optimal efficiency was due to either scour holes under the fencing and/or fallen portions of the fencing caused by sporadic pulse flows from outfall pumping in the area. During the days where trapping efficiency was <100%, trained SCVWD fisheries staff made a unanimous estimate (crew of 3-4 people) of the percentage trap efficiency based on the amount of damage to the trap and the feasibility of fish being able to pass the structure undetected. It was estimated that 5 days the trap operated at 90-95% efficiency, 2 days the trap operated at 70-80%, efficiency, and 3 days the trap operated at 30-40% efficiency.

Total capture of outmigrating salmonids during the 73 day trapping period consisted of 253 steelhead/rainbow and 0 Chinook salmon (Table 1). The absence of any outmigrating Chinook salmon is quite significant given that 77 upmigrating adult Chinook were captured during the 1999 upmigration period. This invaluable data would have gone undetected had we not collected a full year of trapping data (i.e., fall upmigrant trapping & spring outmigrant trapping).

There were 6 trap related smolt mortalities during the trapping period, and 2 handling related smolt mortalities (Table 1). Salmonid mortalities account for only 3% of the total trap capture.

During the 10 days when trapping efficiency was < 100%, 29 additional outmigrating smolts (± 1.45, based on a 95% confidence interval) should be added to the total capture data. This number is a calculation based on the actual catch numbers of salmonids each day, divided by the estimated trap efficiency for that day. The estimated 29 additional smolts account for only 10% of the total steelhead/rainbow trout abundance (n=282) for the 2000 outmigration season (Table 1).

The one day the trap was completely removed from the channel occurred during the peak of the run on April 18, 2000 (Figure 16). The SCVWD is not aware of a statistical model which can accurately fill in the missing data for this day. Based on the small numbers of fish obtained within the system and the notion that outmigrating smolts have a greater tendency to move during high flow events, any estimate of missing data would likely have a large statistical margin of error.

The trap appears to have been installed a bit late and the SCVWD may have missed the very beginning of the outmigration period (Figure 16). The SCVWD is not aware of a statistical model which can accurately predict either the beginning of a run or the tail end of a run without the apex of the capture curve. However, the SCVWD does not feel a statistical model of this magnitude is necessary to apply to this trapping season because of the robustness of the capture data. The SCVWD caught the peak of the migration and the end of the run, and therefore feels that their capture data is a representative index of the outmigrating steelhead/rainbow trout population.

Discussion

Since 1998, the SCVWD has been conducting fish trapping operations for one project or another in various watersheds. Over time the SCVWD's upmigrant and outmigrant trapping methodology has evolved to become quite efficient and effective for trapping salmonids in the small flashy systems within Santa Clara County. The SCVWD believes that the results provided above demonstrate the effectiveness of this trapping system and methodology. The benefits gained from both upmigrant and outmigrant trapping in conjunction with each other can be invaluable for discerning production within a system. The SCVWD believes that provided the appropriate funding to begin trapping early enough in the season and continue trapping till the end of the run that the trapping methodology described above is an effective and successful way to collect the data necessary to develop a population index for adult and juvenile Chinook salmon and steelhead/rainbow trout on the Guadalupe River.

Upon request from NMFS, SCVWD biologists have investigated the plausibility of utilizing a rotary screw trap design instead of the fyke trap design to capture outmigrating fishes on the Guadalupe River. Given the findings listed below, SCVWD biologists are concerned that a rotary screw trap may be inappropriate for the Guadalupe River system.

Mark Wade, owner and manufacturer of the rotary design, has given SCVWD biologists the basic criteria needed to effectively operate this style of trap. He can be contacted by e-mail at egsolutions@hotmail.com or by phone at (541) 752-7810. The smallest trap the company manufactures is the 5-foot diameter design. Water velocities for this trap need to be a minimum of 2 ft/s in order to turn the internal screw core that operates the rotor. If flow requirements are not met, the rotor subsequently becomes jammed with debris making the trap ineffective.

On January 8th and January 22nd, 2002, SCVWD biologists measured velocity at the previous trapping site on the Guadalupe River, downstream of Highway 101, and found a maximum velocity of 1.1 ft/s and 0.89ft/s respectively. These winter velocities are most likely higher than the average velocities found during a spring outmigrant trapping period due to lower streamflow conditions.

Additionally, utilizing the width and depth dimensions taken at the trapping location (cross-sectional area), along with the necessary velocity of 2 ft/s to operate the rotary screw trap, SCVWD biologists have calculated that flows greater than 100 cfs are needed at the site to operate the rotor within the trap effectively. Historical flow data from the Guadalupe River trapping location and the St. John's weir gaging station show a mean daily range of ~35-80 cfs during the typical spring migration timeframe. This range shows that the majority of days during a spring outmigrant trapping period were below the minimum flow necessary to operate a rotary screw trap design. Sufficient flows to operate this style of trap were only achieved during storm events, where flows typically would range between 100 – 1100 cfs.

In addition to velocity requirements, a certain depth is needed for the fixed fishing position of a rotary screw trap. A minimum depth of 2.5 feet is required to accommodate the funnel core attached to the pontoon style floats. Permanent structures or fixtures are needed along the bank or in the channel to secure the trap to a fixed location.

The location previously used for upmigrant and outmigrant trapping on Guadalupe River meets the depth requirement for a rotary screw trap design (average depth 2.8 feet), however; this trapping location has no permanent structures that are capable of securing a large trap in the channel. The bankside vegetation is comprised mainly of cattails and bulrush with a few small willows and cottonwoods. SCVWD biologists have encountered difficulty locating other suitable trapping sites with depths greater than 2.5 feet.

The SCVWD Guadalupe Watershed senior civil engineer, Ken Reiller, is concerned about a trap of this magnitude potentially getting lodged in portions of the river channel critical to flow conveyance causing either structural damage or substantial flooding. This type of trap is typically used in larger, undisturbed systems where safety of bridges and other urban structures are usually not an issue (Oregon Dept. Fish and Wildlife, 2000).

The Oregon Department of Fish and Wildlife has encountered mortalities while using the rotary screw trap. They found at high water velocities fish can get pushed to the back of the live box, which can lead to exhaustion for the smaller fish. A v-shaped deflector can be place in the live box to reduce water velocity in the box (Oregon Dept. of Fish and Wildlife, 2000). The SCVWD encounters the same possibility of mortalities at high flows with the fyke trap design however; the fyke trap can be easily removed at high flows without the aid of heavy equipment, therefore reducing the probability of trap related mortalities. In 2 seasons of outmigrant trapping on Coyote Creek (1999 & 2000), the SCVWD salmonid mortality rate has been 1% and 3% respectively.

Historical stream gauge data on the Guadalupe River demonstrates that flows can increase very rapidly due to impervious surfaces and other urban structures in this watershed. This may present a problem with removal of the rotary screw trap. The runoff is so quick that it may be difficult to assemble a crew and machinery in an appropriate time frame.

In order to service the mitigation and monitoring plan for the Guadalupe Flood Control Project and to collect invaluable salmonid production data within the Guadalupe watershed, SCVWD biologists believe that the fyke trap design, described above, may be the best alternative for outmigrant trapping on the Guadalupe River.

FIGURES & TABLES

UPMIGRANT TRAPPING

Upmigrant Trapping Season (Dates)	Number of Days In Trapping Season	Number of Days Trap Fished at 100% Efficiency	Number of Days Trap Fished under 100% Efficiency	Number of Days Trap Was Completely Removed From Channel	Number of Chinook Salmon Captured	Number of Steelhead/Rainbow Trout Captured	Number of Chum Salmon Captured	Number of Pink Salmon Captured	Total Number of Trap or Handling Related Salmonid Mortalities	* Calculated # of additional Salmonids based on daily trap efficiency estimates (<100%)	Total Salmonid Abundance (fish captured + additional fish from efficiency estimates)
GUADALUPE RIVER											
July 16, 1998 - January 15, 1999	183	140	17	26	84	4	0	0	0	1	89
August 13, 1999 - October 2, 1999	50	48	2	0	40	0	1	0	1	1	42
August 17, 2000 - October 10, 2000	54	51	3	0	13	0	1	1	0	0	15
September 12, 2001 - November 24, 2001	73	56	12	5	49	1	2	0	0	10	62
COYOTE CREEK											
August 24, 1999 - November 8, 1999	76	73	3	0	77	0	0	0	1	2	79

* This number is based on daily efficiency estimates at the trap site and is calculated from the actual catch numbers of fish each day divided by the estimated trap efficiency for that day.

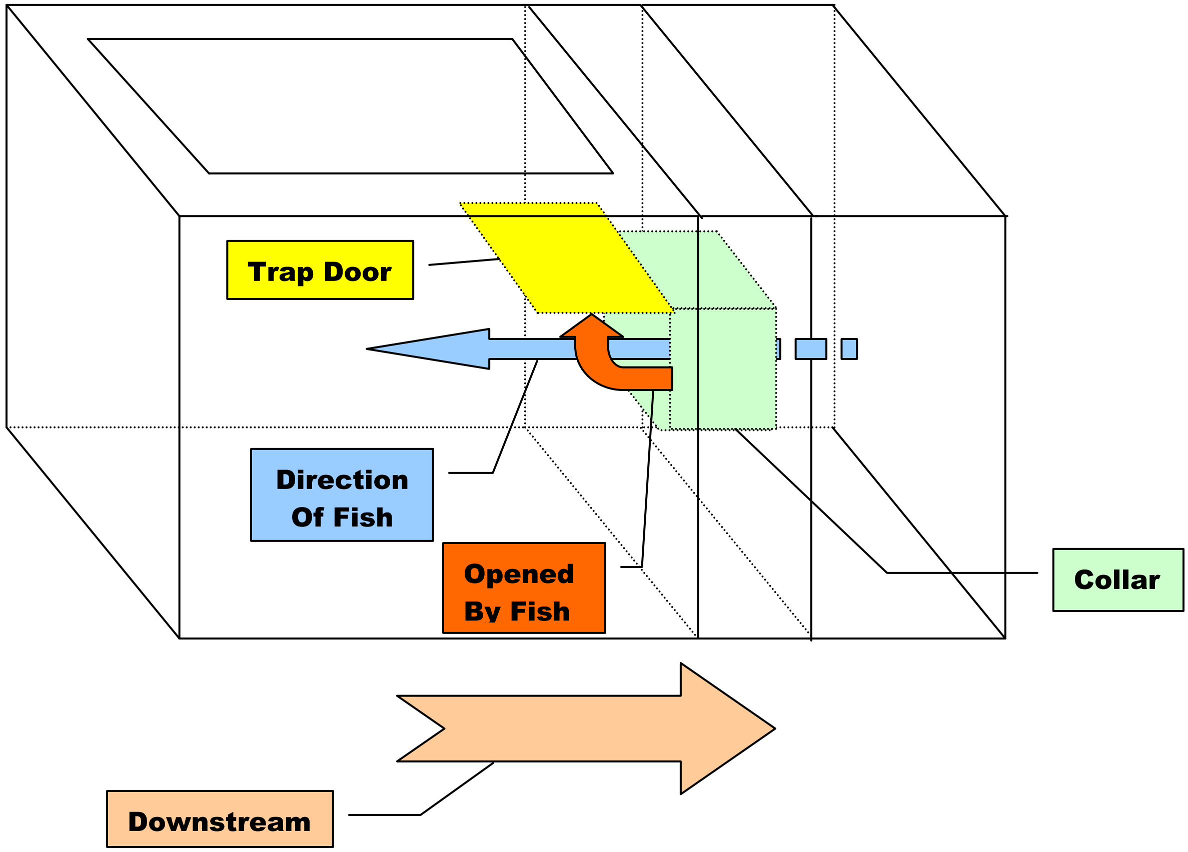
OUTMIGRANT TRAPPING

Outmigrant Trapping Season (Dates)	Number of Days In Trapping Season	Number of Days Trap Fished at 100% Efficiency	Number of Days Trap Fished under 100% Efficiency	Number of Days Trap Was Completely Removed From Channel	Number of Chinook Salmon Captured	Number of Steelhead/Rainbow Trout Captured	Total Number of Trap or Handling Related Salmonid Mortalities	* Calculated # of additional SH/RT based on daily trap efficiency estimates (<100%)	Total SH/RT Abundance (fish captured + additional fish from efficiency estimates)
COYOTE CREEK									
April 14, 1999 - June 14, 1999	61	55	5	1	172	162	2	1	163
April 4, 2000 - June 15, 2000	73	62	10	1	0	253	8	29	282

* This number is based on daily efficiency estimates at the trap site and is calculated from the actual catch numbers of fish each day divided by the estimated trap efficiency for that day.

Table 1. Compilation of SCVWD Salmonid Trapping Information.

A) Upstream Migrant Trap Cage Design



B) In Channel Trap Configuration- Top View

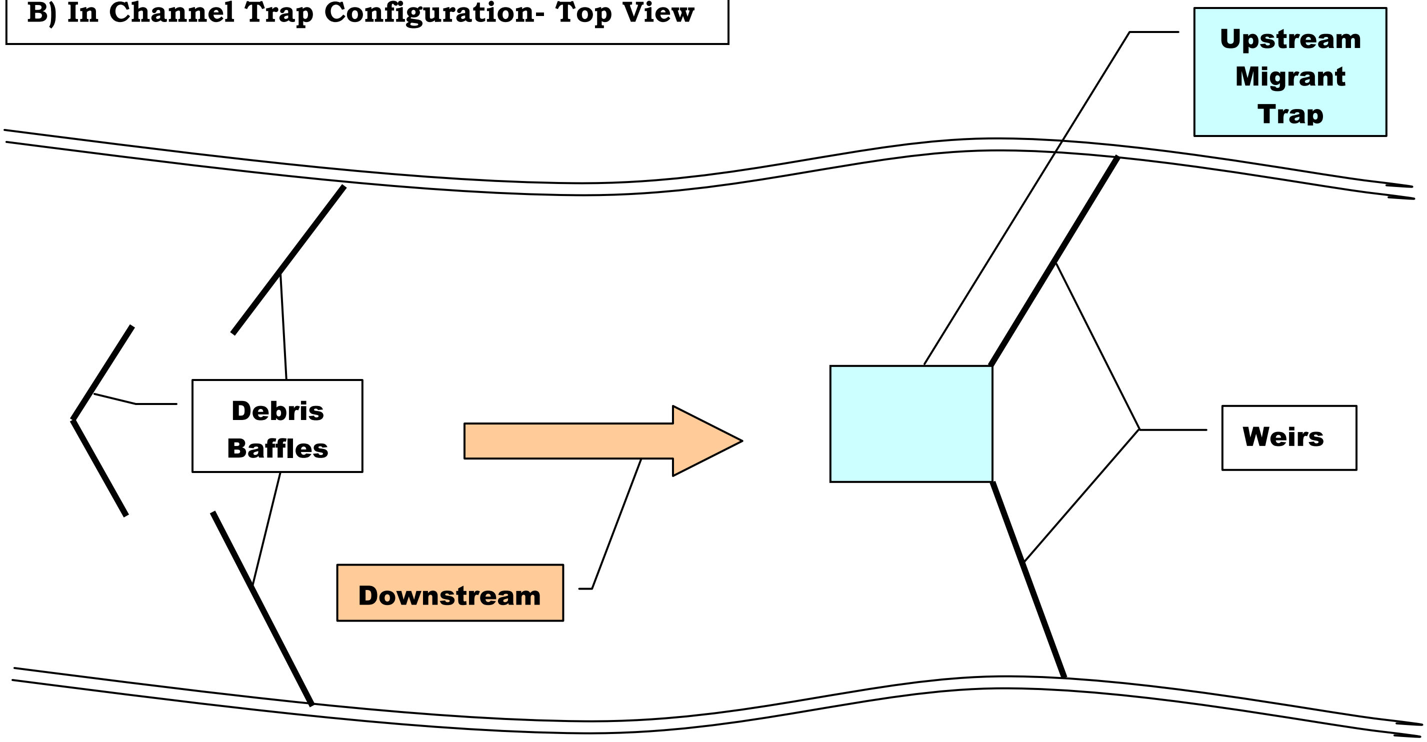


Figure 1 Diagram of Upmigrant Salmonid Trap

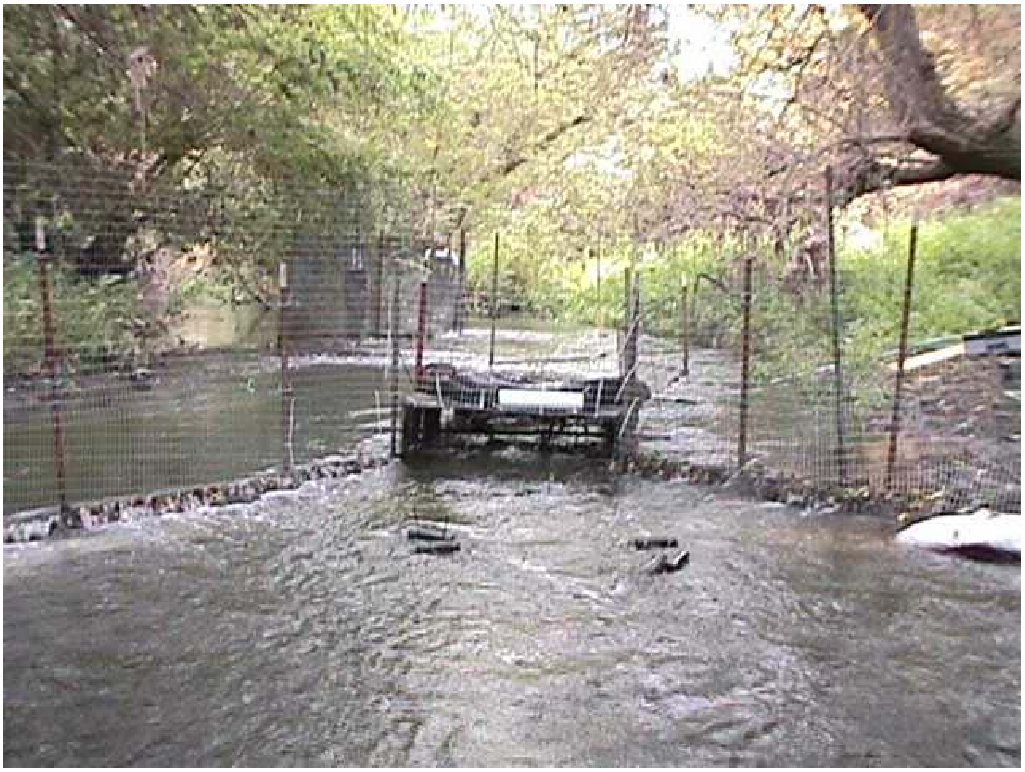


Figure 2. Photograph looking upstream at V-weir fencing and trap cage setup for the adult upmigrant trap.

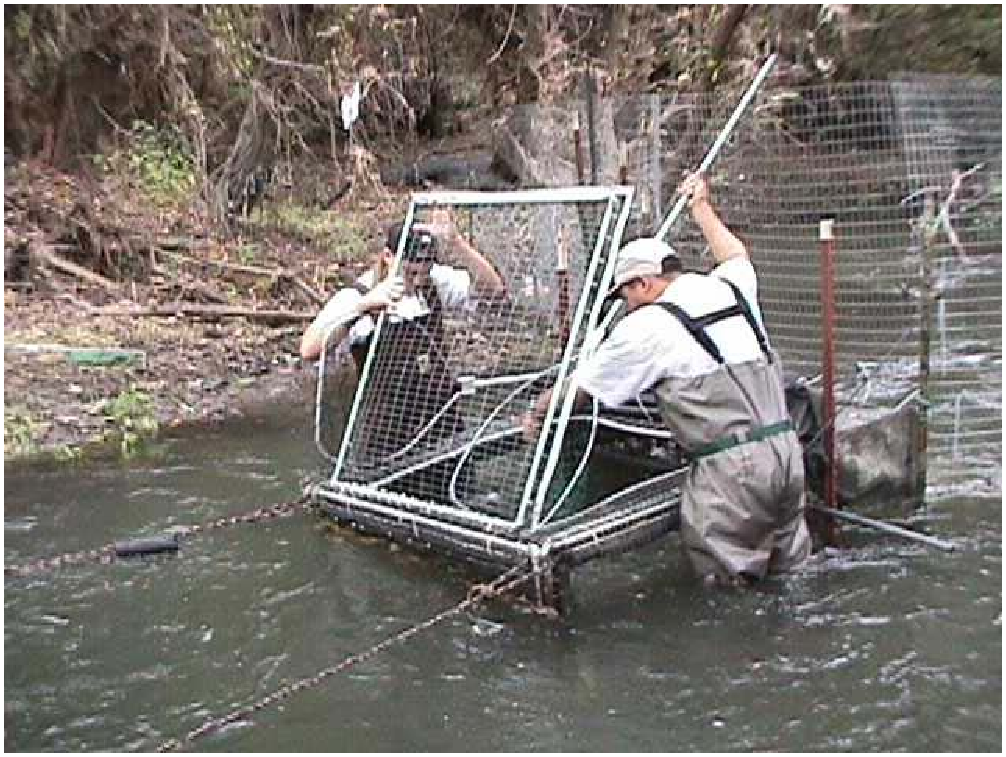


Figure 3. Photograph of hinged lid and the trap being serviced.

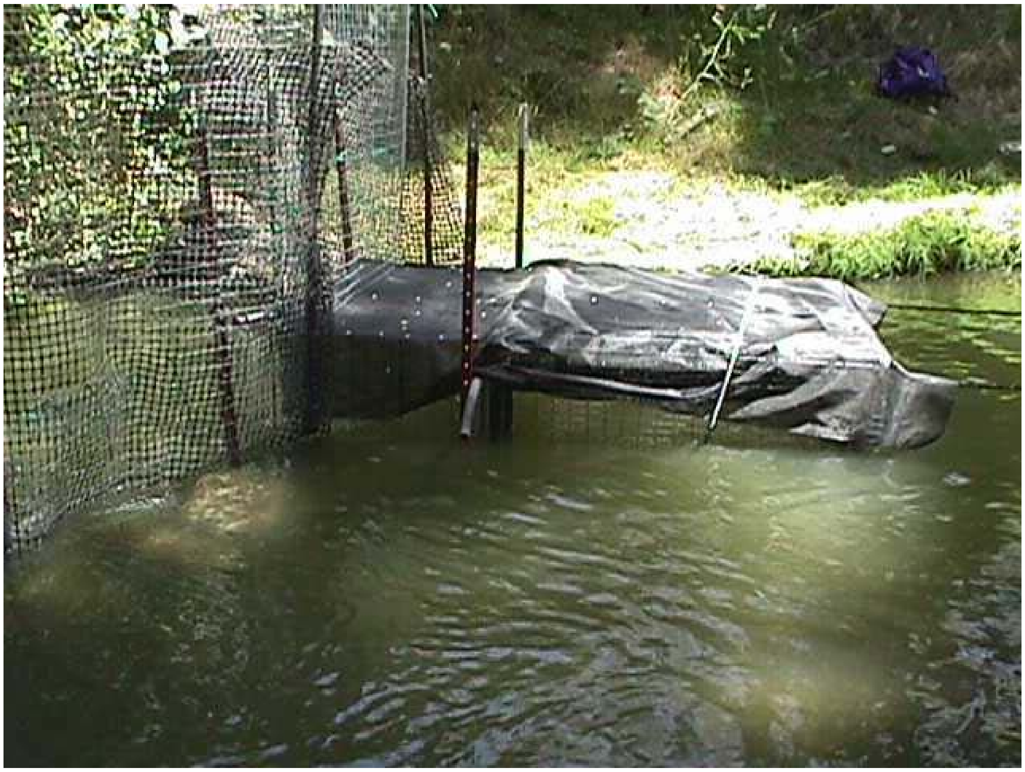


Figure 4. Photograph showing shade cloth over trap cage and "peel off" fencing on the weir.

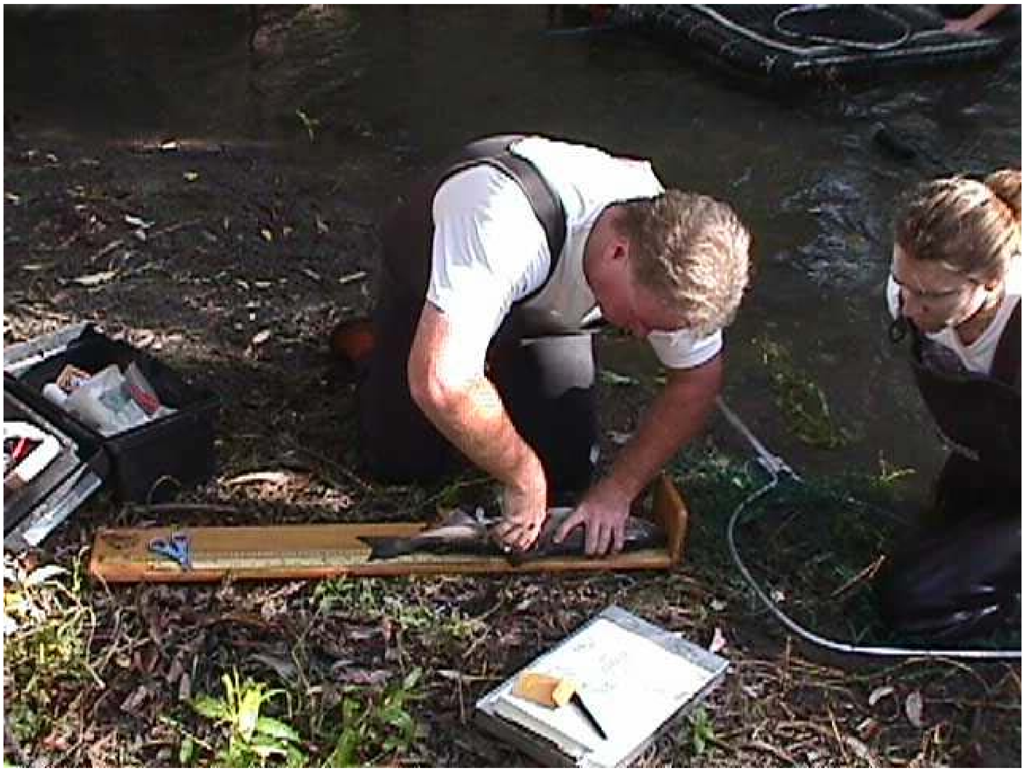


Figure 5. Photograph showing measurements being taken of an adult chinook.

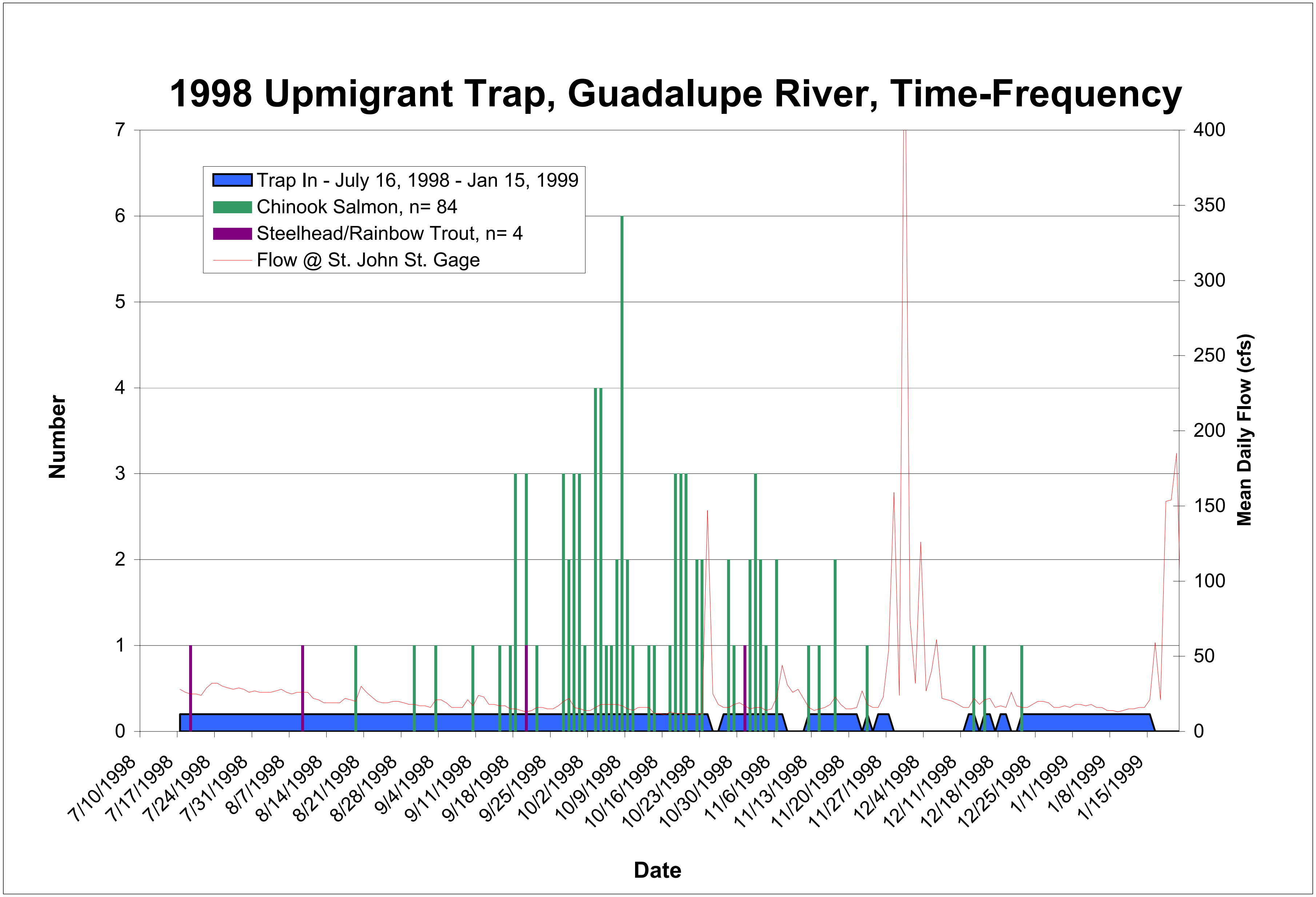


Figure 6. 1998 Upmigrant Trap Guadalupe River.
*Trap out 26 days out of a total 183 days due to high flows:
10/25-10/26, 11/8-11/11, 11/22, 11/24, 11/28-12/11, 12/14, 12/17, 12/20-12/21

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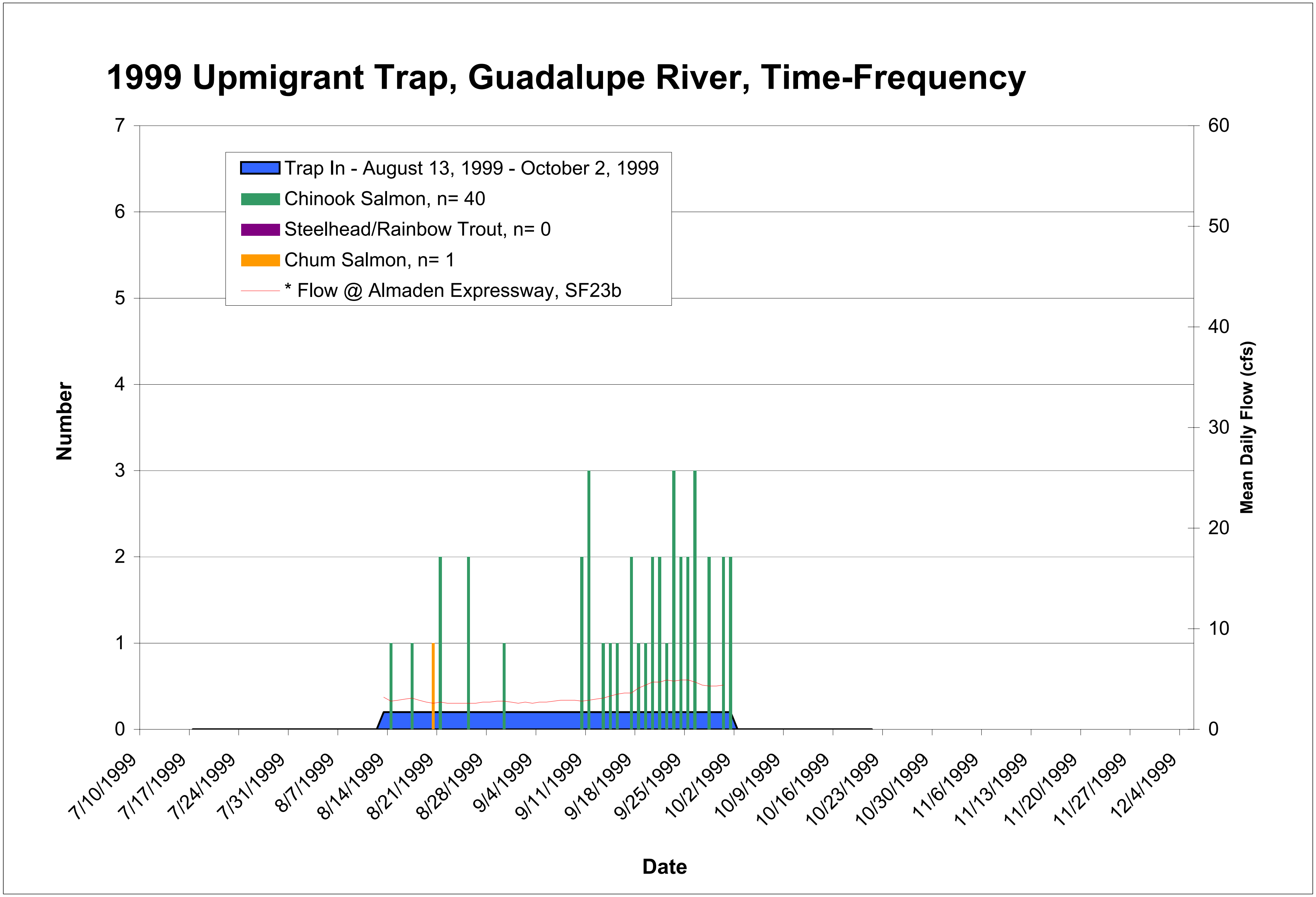

Figure 7. 1999 Upmigrant Trap Guadalupe River.

* Stream flow data from Almaden Expressway gage 23b used in place of St. John Street, due to malfunctioning gage.

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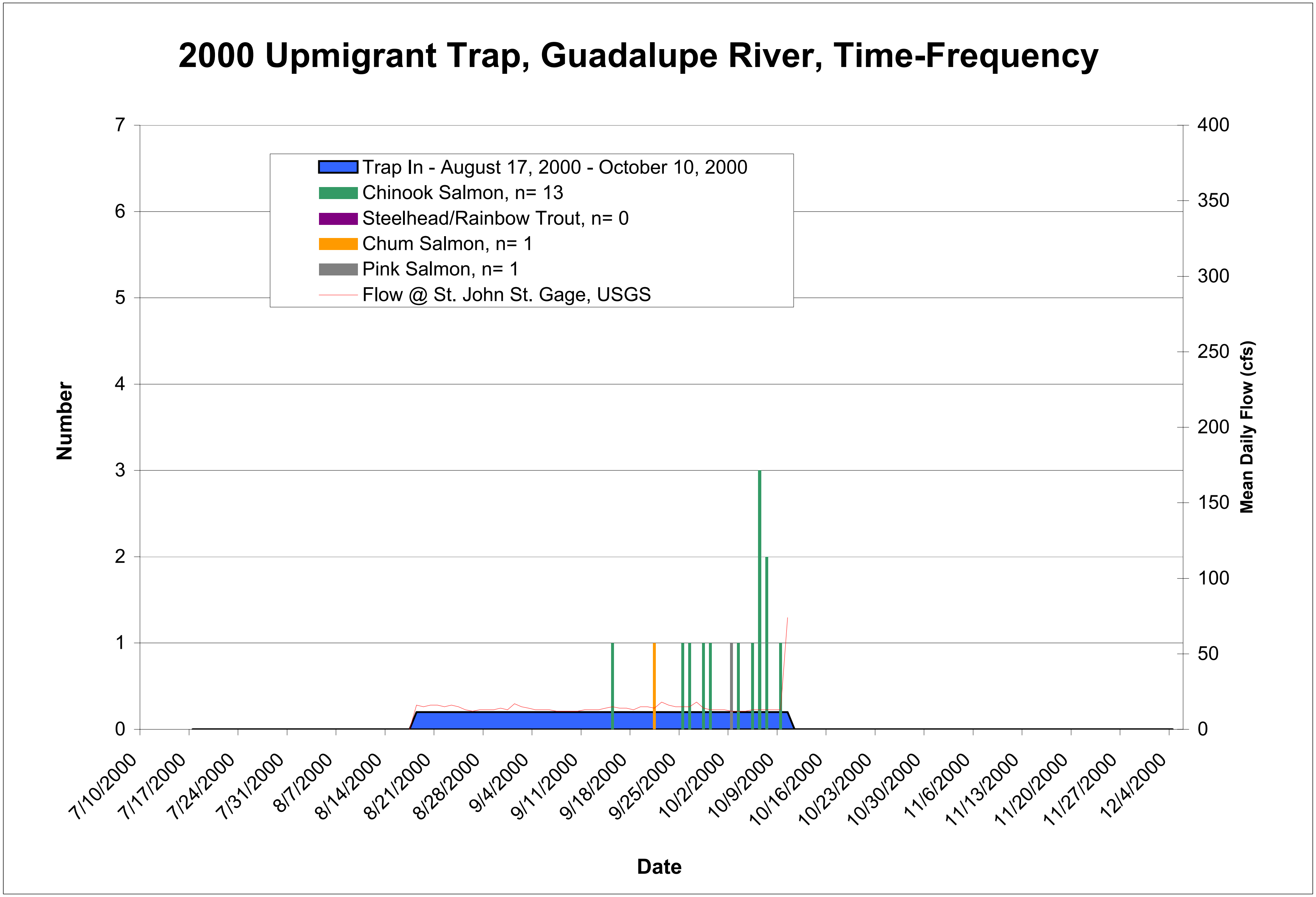

Figure 8. 2000 Upmigrant Trap Guadalupe River.
* Trap fished for 54 consecutive days when funding problems caused its removal.

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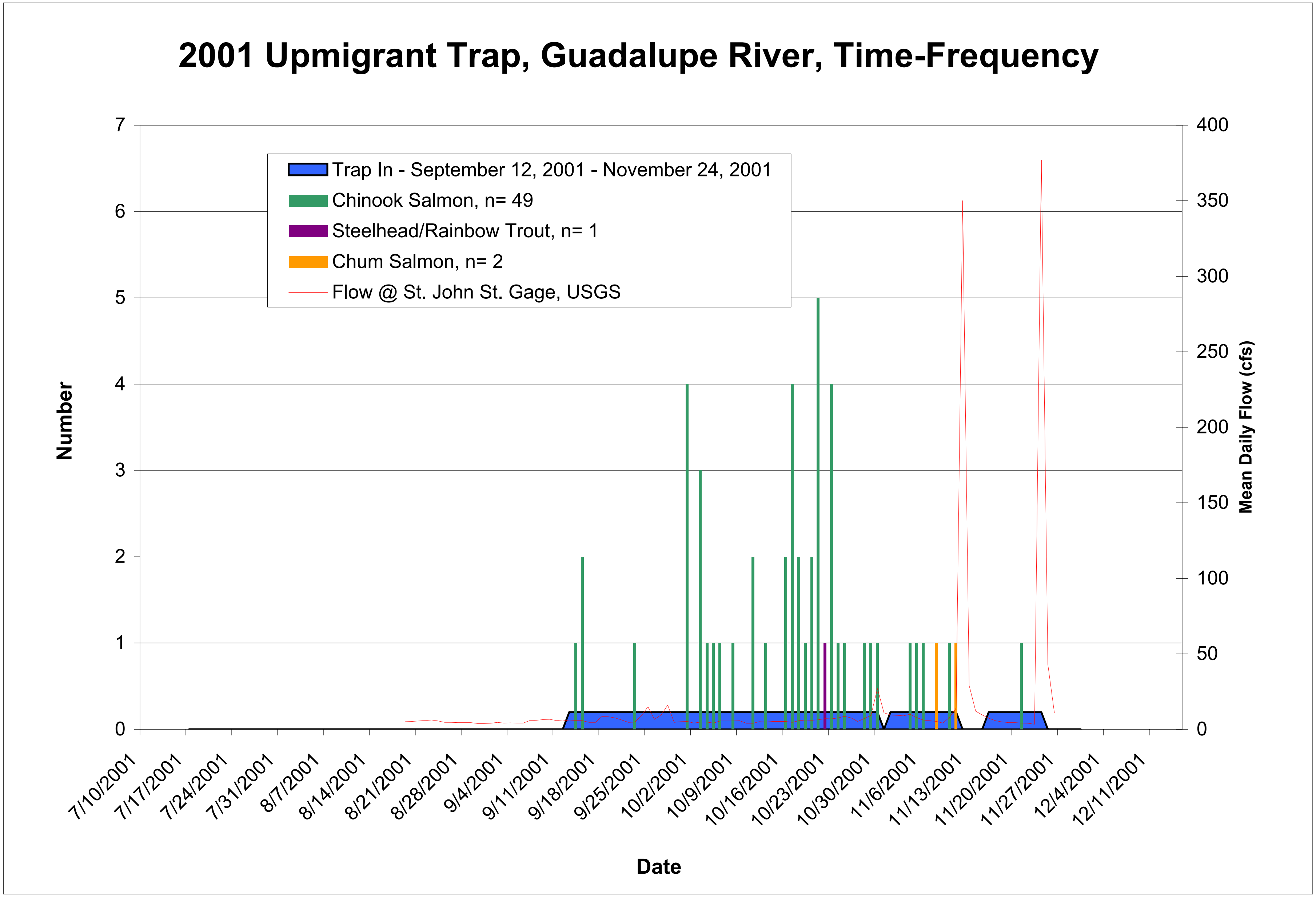

Figure 9. 2001 Upmigrant Trap Guadalupe River.
* Trap out 5 days out of a total 73 days due to high flows: 10/31, 11/12-11/15

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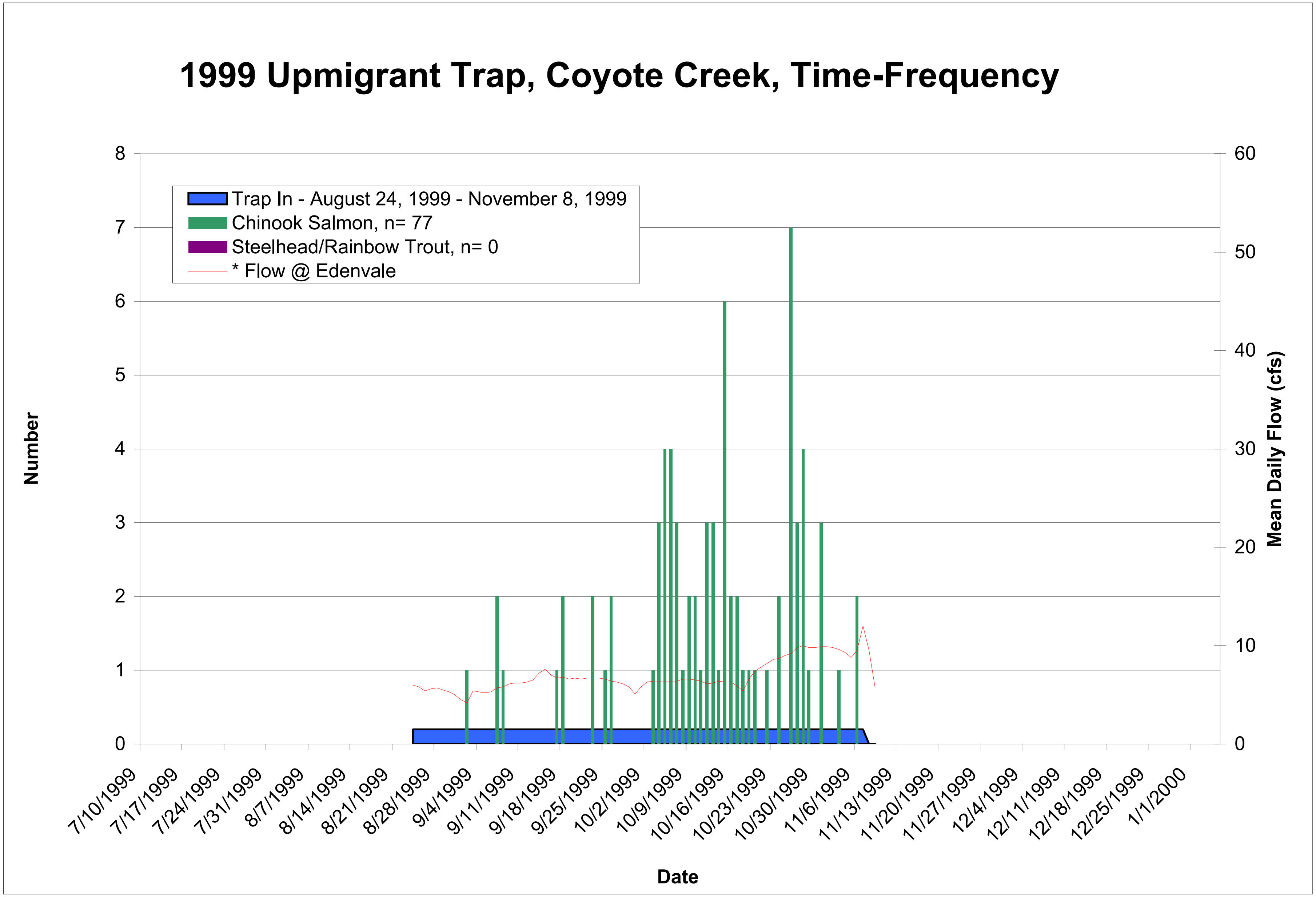

Figure 10. 1999 Upmigrant Trap Coyote Creek.

* The Edenvale stream gage is approximately 13.5 miles upstream of the trapping site.

** Trap fished for 76 consecutive days.

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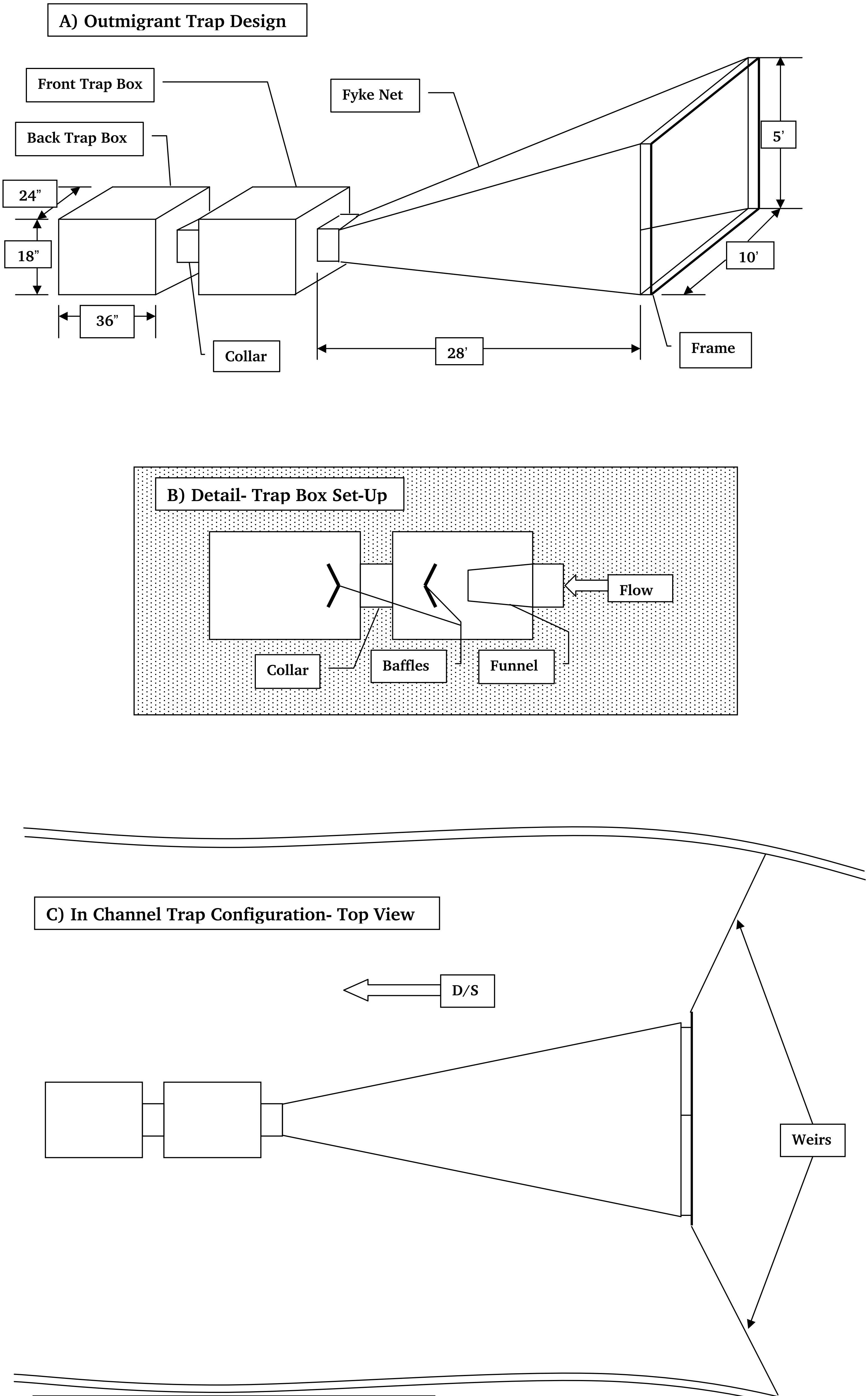

A) Outmigrant Trap Design

B) Detail- Trap Box Set-Up

C) In Channel Trap Configuration- Top View

Figure 11 Diagram of SCVWD Outmigrant Trap

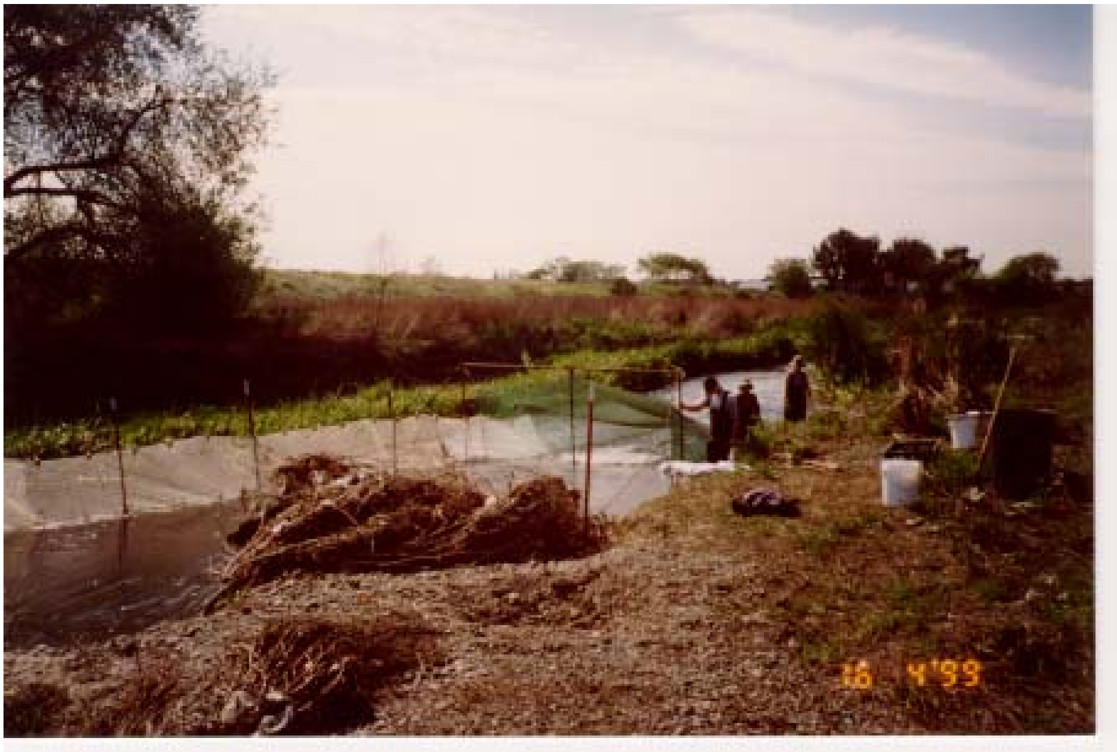
16 4'99

Figure 12. Photograph taken looking downstream shows the wings of the trap. Left side is fencing covered with ½ inch mesh netting, while the right side is sandbagged to divert fish into the trap.

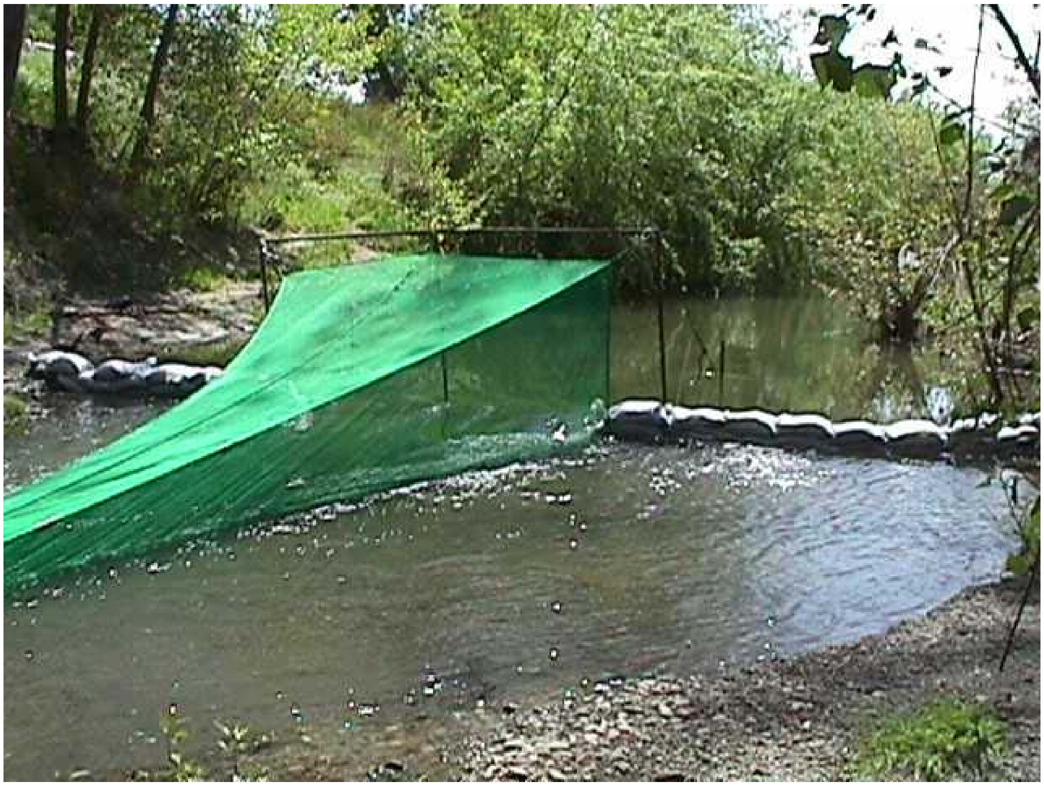

Figure 13. Photograph taken looking upstream, showing the taper of the fyke net and the sandbag placement to divert fish to the net opening.

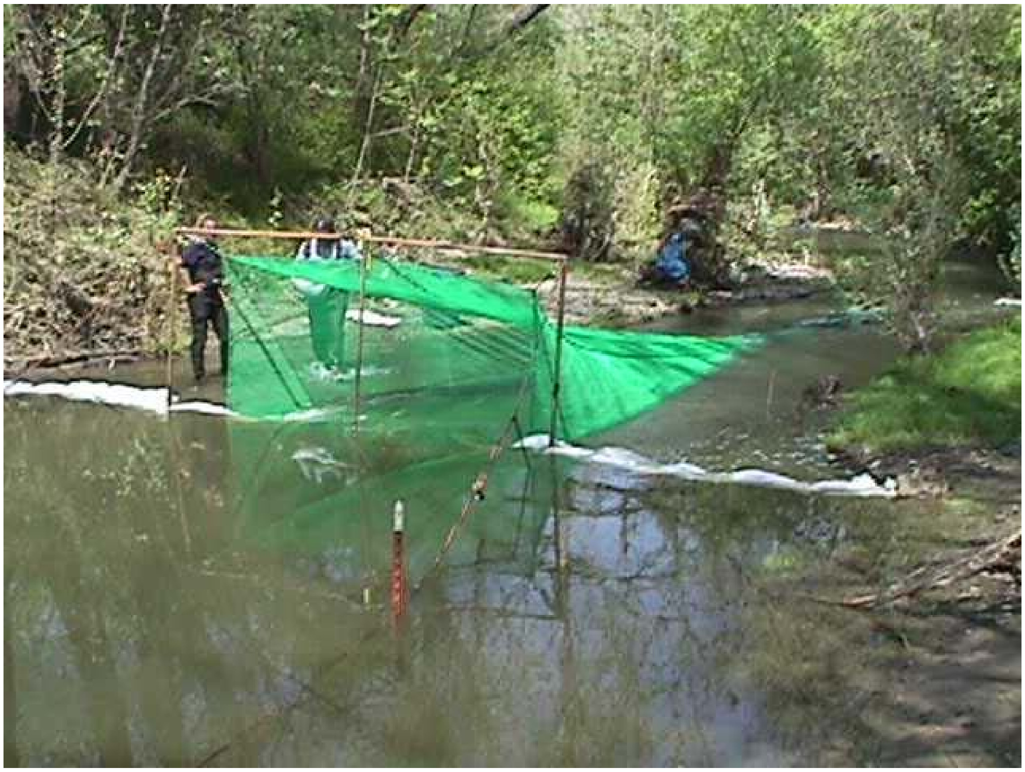

Figure 14. Photograph taken looking downstream into the mouth of the fyke net.

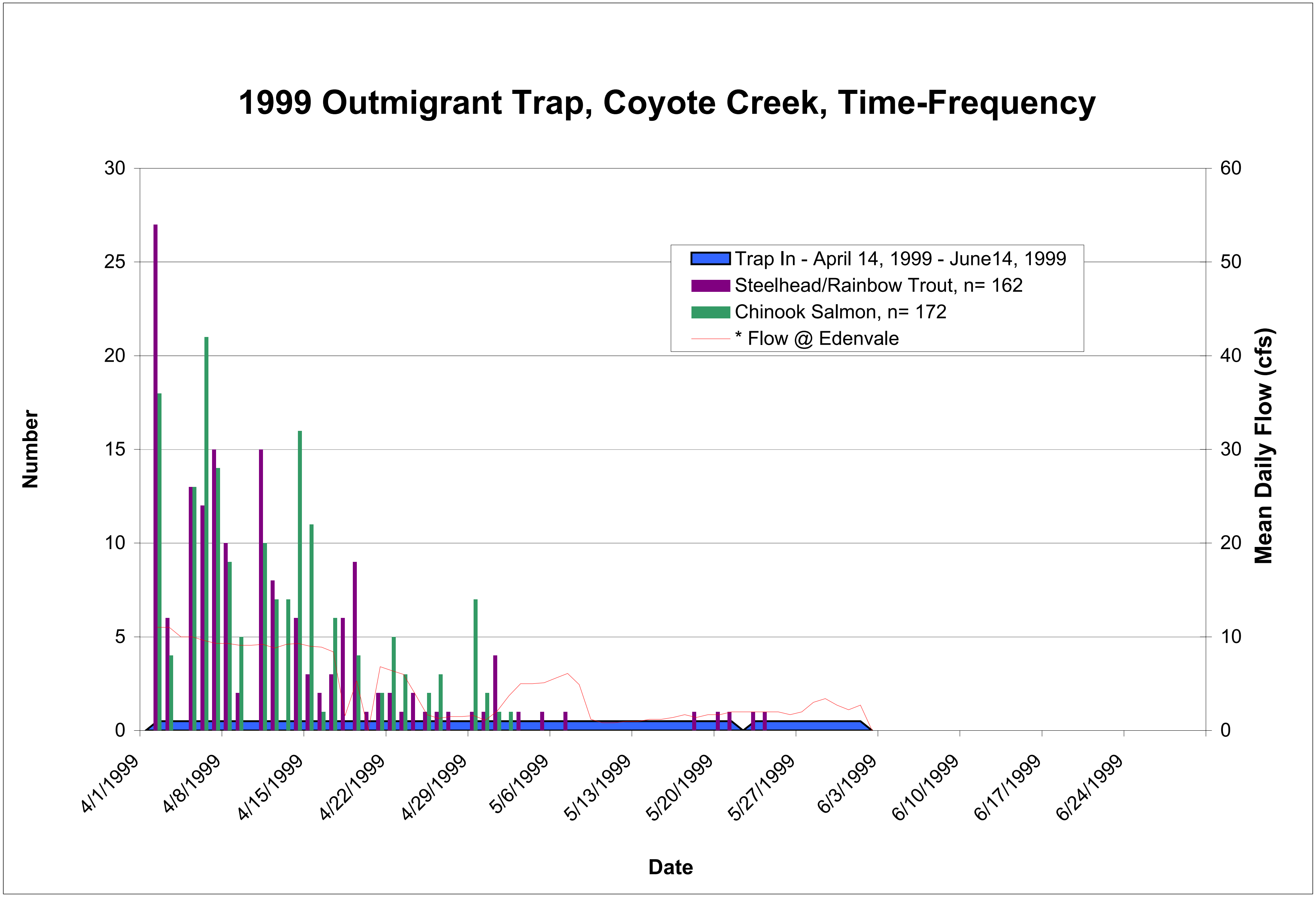

Figure 15. 1999 Outmigrant Trap Coyote Creek.
*The Edenvale stream gage is located approximately 13.5 miles upstream of the trapping site.
*The trap was out for only 1 out of 61 total trapping days: 6/4

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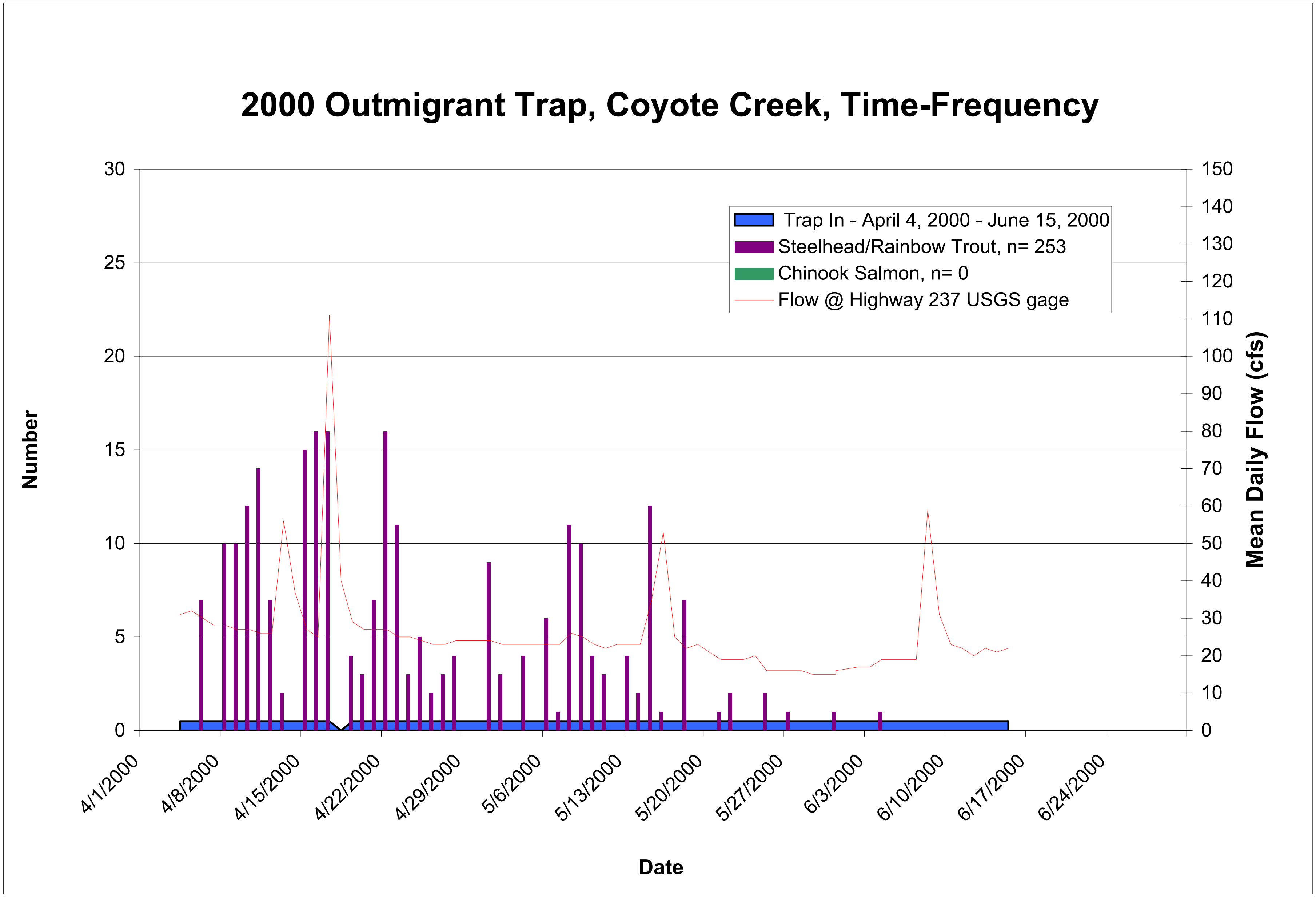

Figure 16. 2000 Outmigrant Trap Coyote Creek.

* The trap was out for only 1 out of 73 total trapping days: 4/18

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